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September 11, 1997

Defense Technical Information Center
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Alexandria, VA 22304-6145

Re: Grant #MDA972-95-1-0014

To whom it may concern:

Enclosed are two copies of the final report for the referenced grant entitled "Advanced Education and Training Technologies Consortium" by Drs. E.W. Zimmers, Jr. and Leroy J. Tuscher.

If you have questions or require additional information, please feel free to contact me at (610)758-3024 or via e-mail at RT01@lehigh.edu.

Sincerely,

Ruth Tallman

Ruth L. Tallman
Program Administrator

Enclosures

cc: E.W. Zimmers, Jr.
Leroy J. Tuscher
LU #533689

Final Project Report

Agency: ARPA Northeast Regional Consortium
Project Title: Advanced Education and Training Technologies Consortium: The Northeast Regional Consortium Program: Phase I – Proof of Concept and Planning.

The Enterprise Systems Center (ESC) at the Lehigh University successfully completed the project in December 1995. The ESC worked closely with the members of ARPA Northeast Regional Consortium and provided leadership and planning support to embrace and adopt an Agile Learning Paradigm.

Team Members: The Enterprise Systems Center worked with the following members of the consortium

1. ARPA
2. Eastern Technology Council
3. Learning Research and Development Center, University of Pittsburgh
4. Loral Defense Systems – Eagan
5. Massachusetts Institute of Technology (MIT)
6. NIST
7. Office of Science and Technology Policy, Executive Office of the President
8. The Franklin Institute
9. TRO Learning, Inc.
10. Unisys
11. University of Massachusetts, Amherst
12. University of Pennsylvania

Enterprise Systems Centers project was concentrated on researching the needs and opportunity and providing leadership to the members of the consortium. In Phase I, scope of the project involved:

A) Scope training needs and related technological advances (evaluate needs, develop training framework in agile paradigm, and analyze potential of technologies)
B) Adapt agile paradigm to learning

Some of the findings of this project are:

I) Needs and Opportunities: The ESC provided research assistance and leadership to study the results of national skills standard, identify the training requirements of emerging technical occupations, analyzing regional and state skill base, and to seek input from the industry. Some of the findings of the needs and opportunity study were:

A) Market Influences: The changing competitive environment is placing increasing demands on the workplace and the skills required for Pennsylvania employers to be competitive. New approaches to education and training are essential.

1) Powerful trends are impacting the competitive environment for PA firms:

2) As a result of these trends, the workplace is changing dramatically, impacting the kinds of jobs available and the skills required for those jobs.
3) What is taught and how it is taught must be changed.
4) Educators, businesses, and communities must partner in new ways.
5) Technology provides the opportunity to explore new approaches for learning and improve the quality and quantity of education available.

- A 1995 survey of more than 100 recent academic studies indicated that technology-based instruction significantly improved student performance in English, language arts, math, history/social science, and science.
- The U.S. military found that trainees reached required competencies in 30% less time with computer-based instruction than with standard methods. A computer-based program targeted to remedial students in New York City demonstrated 80 percent gains in reading and 90 percent in math.
- California has unveiled an initiative called C3 - Connect, Computer, and Compete - to move Californian's into the 21st Century. Michigan has unveiled an initiative MIN (Michigan Information Network) to connect schools and citizens on the Information Superhighway.
- Focus:Hope's "Fast Track" self-paced computer-based learning system successfully moves hundreds of inner city high school graduates from eighth grade reading and math levels to 10th grade in seven weeks.

B) Pennsylvania's Competitiveness and Market Opportunities

1) Business growth in Pennsylvania is not competitive with other regions of the country.
- According to the Sixth Annual Pennsylvania Economy Survey by Coopers & Lybrand L.L.P., Pennsylvania ranks 48th in the nation in the creation of new business.
- The prediction for business growth is dropping.

2) Pennsylvania ranks third from last (47^{th}) in regard to use of computer technologies in schools (1995 Quality Education Data Inc. survey)

3) In Pennsylvania, technology has the potential to bridge gulfs between "haves" and "have-nots" for individuals, schools, firms, and communities.
- Technology has the potential to offer unemployed, dislocated, and welfare workers access to educational resources equal to those available to the employed worker or the worker with sufficient financial resources to fund his/her own education/ training.
- Technology can bridge gulfs between access to resources in rural and more urban areas.
- Technology can bridge gulfs between access to educational resources by small and large firms.

4) There is a myriad of workforce development resources available in the region which for the most part currently operate independently of one another to serve specific

populations. The result is fragmentation and lack of coordination of education and job training services.
The members of the consortium agreed to develop a "needs profile" by –

- Examining of human factors as well as technical areas,
- Utilizing skill assessment kits,
- Identifying curricula priorities, and
- Defining configurable and modular packages.

II) The Consortium needs to adopt the Agile Learning Paradigm to Learning: As corporations across the world embrace the agile manufacturing and virtual corporations paradigm, the educational institutes have to get ready to provide future workforce ready for their challenges. ESC provided an understanding of the key dimensions of agile competition to the group. These dimensions are a) Enriching the customer, b) Cooperating to Enhance Competitiveness, Organizing to Master Change, and d) Leveraging the Impact of People / Information. These principles need to be used to integrate the advanced technologies and innovative delivery techniques in the education, learning, and training fields. These key dimensions provide a strong strategic foundation to evaluate the emerging technology, apply the existing technology, and customize learning to provide Just-In-Time education and training.

Enterprise System Center helped the members of the consortium to draw a parallel between the principles of agility and education / training. For example,

- Instructions must be learner centered and not instructor centered.
- Individualized instructions need to server the specific requirements of the learner and the employer.
- Training package needs to be learner configurable, modular, dynamic, extensible and upgradable.
- Teaming of appropriate resources is necessary to meet the specific training and educational needs of the learner.
- Individuals representing each of these organizations need to bring to the operations team diverse knowledge and expertise.
- It is necessary to have open mind, new perspective, and the ability to think "out-of-the-box"; and the ability to work effectively as equals in a group.
- Unique attributes (core competencies) and active participation of consortium members in defining new learning approaches is a key to ensure a collaborative effort with long-term successful impact.
- It is critical to ensure open communication and dissemination
- The consortium needs to develop a strategic Educational Master Plan (EMP) to meet the regional manufacturing sector needs.
- Technological advances in artificial intelligence, cognitive science, computer science, and software engineering need to be utilized for the development and dissemination of the educational material.
- To improve the interaction with the trainer and peers it is essential to develop multi-sensory learning kiosks, peer to peer dialogue, and emphasize Hands-on Experience.

III) Analyze application potential of new technology: With the limited time and money availability the consortium will pick one or two carefully selected areas for demonstration. In order to reach a broad spectrum of population advanced technology needs to be explored. The consortium will select testbeds to demonstrate the application of this technology. In order to generate interest in manufacturing field among young adults and kids, a new paradigm "learning through manufacturing" was proposed.

ESC evaluated the potential of training and educational technology such as video conferencing, desktop video conferencing, Computer Based Training, and Multi Media. The consortium agreed to develop two courses using the multimedia technology, one on statistical process control / ISO 9000 certification, and second on teamwork and overall communication issues. The consortium also agreed to support the activities of the South East Pennsylvania Regional Employment and Training Center.

For the Franklin Institute, the consortium members brainstormed ideas for designing and developing deeper technology exhibits (electronic simulations / WWW). These exhibits will help the patrons in understanding basic issues such as, what it means to do a particular manufacturing job. Patrons also will be able to produce something by using their own science and math knowledge. The Franklin institute will also conduct research on "mobile gadgets" that help you plan your trip based on your previous knowledge and experiences.

The consortium members agreed to continue the collaborative effort in the second phase. In the second phase emphasis will be given on the actual prototyping and testing of selected educational material and dissemination technology.